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(54) BEARING UNIT FOR SPINDLE MOTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To set a gap accurately in the thrust direction by employing a spherical shape at one end of a shaft and disposing a thrust direction regulating plate to be coupled with a radial groove part made in the vicinity thereof through plastic flow.

SOLUTION: A groove 2a is made in the outer circumference of a shaft 2 and fitted with a stopper plate 3 and then the end face thereof is collapsed to make a recess 3a so that a material flows while being deformed plastically into the groove 2a. When the end face is collapsed, the upper and outer circumferential surfaces of the stopper plate 3 are received by a jig such that a plastic flow takes place surely in the vicinity of the groove 2a. According to the arrangement, removing strength in the thrust direction and impact resistance are enhanced. Furthermore, a gap can be set accurately between the plate and the bearing end part because the part for receiving the shaft having spherical end is press-fitted into a bearing housing while allowing adjustment in the thrust direction.

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2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] It supports free [a revolution] by the bearing metal which carried out the inner package of the shaft joined to the hub to bearing housing. In the hydrodynamic bearing equipment of the spindle motor which forms a motor with the stator core fixed to the periphery of bearing housing, and the Rota magnet fixed to said hub, and carries out revolution actuation of the hub by the motor While installing the plate for the thrust direction regulation which makes one edge of said shaft a spherical-surface configuration, forms the slot of the direction of a path in this near, and is combined with a part for this slot by plastic flow The receptacle member which supports said spherical-surface configuration section is pressed fit in said bearing housing in airtight, and the thrust direction clearance between said plate and one edge of said bearing which counters Bearing equipment for spindle motors characterized by measuring a motion of the thrust direction of said receptacle member, and enabling it to set up.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] With respect to the motor which used the hydrodynamic bearing, this invention is especially used for a magnetic disk drive, an optical disk unit, etc., and its precision is high and it relates to the bearing structure of a spindle motor excellent in shock resistance.

[0002]

[Description of the Prior Art] In the spindle motor used for information machines and equipment etc., although what used the ball bearing for support of body of revolution was in use, it had become the hindrance of rotational high-degree-of-accuracy-izing and improvement in the speed. On the other hand, when a hydrodynamic bearing is used, since body of revolution is supported by non-contact with a fluid, a very highly precise revolution is possible, and while it is suitable for high-speed revolution-ization, it is effective in respect of silence. In the conventional hydrodynamic bearing spindle motor, although it can classify into two, an axial cover half and an axial revolution mold, since it is necessary to thicken the base and since it fixes based on a shaft, and the structure becomes complicated, in the case of an axial cover half, a problem is in thin-shape-izing of

a spindle motor, and low cost-ization. In the case of the axial revolution mold, compared with the axial cover half, it is unnecessary, and since the structure is easy, the axial fixed part is suitable for thin-shape-izing of a spindle motor, and low cost-ization.

[0003] However, in the case of an axial revolution mold, it is necessary to give the omission preventive measure of a shaft, and is publication-number 5-. The structure of forming a disc-like larger thrust plate than the diameter of a shaft in the edge of a shaft, preparing thrust bearing in the vertical end-face section of a thrust plate, and preventing the omission of a shaft in a No. 321928 official report is indicated. Moreover, in the case of a hydrodynamic bearing, leakage of lubricant causes the poor lubrication of bearing and a bearing life is reduced.

[0004] Further for example, when it uses for a magnetic disk drive, the revealed lubricant may pollute a magnetic disk and the magnetic head, and a head crash may be generated. Therefore, a means to prevent leakage of lubricant is needed. In order to prevent leakage of lubricant, in JP,3-272318,A, the inside of bearing equipment is filled with the magnetic fluid which is lubricant, and the structure which prepared the magnetic fluid seal in the ends side of radial bearing is indicated.

[0005]

[Problem(s) to be Solved by the Invention] If it is in the conventional

hydrodynamic bearing spindle motor, when forming thrust bearing in the thrust plate bottom, it is necessary to thicken the plate which counters a thrust plate, and becomes the hindrance factor of thin-shape-izing of a spindle motor. Moreover, if a motion of the thrust direction of a shaft is large by the mechanical shock, there is a possibility that a head may break and it is necessary to set up the clearance strictly by contact on a magnetic disk and the head for record reading.

[0006] For this reason, the process tolerance of each part article becomes severe, and causes lifting of a manufacturing cost. Furthermore, with said structure, in order to receive the load of the thrust direction by contact to a plate and a bearing end face, frictional resistance is large, as a result the problem which causes the increment in the consumed electric current of a motor also has it.

[0007] The object of this invention is to offer the hydrodynamic bearing for spindle motors with little consumed electric current while it does not require the process tolerance of each part article so much but can set up the thrust direction gap with a sufficient precision.

[0008]

[Means for Solving the Problem] It supports free [the revolution by the bearing metal which carried out the inner package of the shaft joined to the hub to

bearing housing], in order to attain the aforementioned object. In the hydrodynamic bearing equipment of the spindle motor which forms a motor with the stator core fixed to the periphery of bearing housing, and the Rota magnet fixed to the hub, and carries out revolution actuation of the hub by the motor While installing the plate for the thrust direction regulation which makes one edge of said shaft a spherical-surface configuration, forms the slot of the direction of a path in this near, and is combined with a part for this slot by plastic flow The receptacle member which supports said spherical-surface configuration section is pressed fit in said bearing housing in airtight, and the thrust direction clearance between said plate and one edge of said bearing which counters is the configuration of the bearing equipment for spindle motors measures a motion of the thrust direction of said receptacle member, and it enabled it to set up.

[0009] That is, since it was made to be combined with the slot which prepared the plate for the thrust direction regulation in the shaft by plastic flow according to this invention, the omission reinforcement of the thrust direction is high and becomes the thing excellent in shock resistance. Moreover, since the receptacle member to which the end-face section supports the shaft of a spherical-surface configuration constituted so that it might be pressed fit in bearing housing possible [the thrust direction adjustment], while it can set up the clearance

between a plate and a bearing edge with a sufficient precision, it is small in the frictional resistance of shaft orientations, therefore can lessen the consumed electric current of a motor.

[0010]

[Embodiment of the Invention] The example of this invention is explained referring to drawing 1 . Drawing 1 shows the spindle motor part of the magnetic disk drive which used the hydrodynamic bearing. 1 is a hub, and a disk is laid in a flange 7 and it is fixed with the clamp equipment which is not illustrated and the screw thread screwed in a thread part 17. 2 is a shaft and is supported by the bearing metal 12 of bearing equipment 4 free [a revolution]. The upper part of a shaft 2 is unified by adhesion, welding, etc. in the fitting section 19 with said hub 1, and the soffit section is supported by the thrust pad 10 in the spherical-surface configuration. Moreover, the stopper plate 3 for the thrust direction regulation is unified near the soffit section of a shaft 2.

[0011] Said thrust pad 10 is fitted in the seal magnet 8 and the lower part which were magnetized by shaft orientations between the bearing metal 12 of 9 or 2 seal members in the upper part in airtight at the bearing housing 11. A magnetic fluid is poured into ** 13 as lubricant, and, as for this bearing equipment 4, adhesion immobilization of the periphery of the bearing housing 11 is carried out at the base 14.

[0012] 15 is a stator core made from silicon steel, a coil 16 is wound and adhesion immobilization of it is carried out at the base 14. The periphery of a stator core 15 has countered the bore of the Rota magnet 5 in the predetermined opening. 6 is comparatively soft metal rings, such as aluminum and copper, this is crushed and the Rota magnet 5 is being fixed to the hub 1.

[0013] Next, drawing 2 , drawing 3 , drawing 4 , and drawing 5 explain the detail of bearing equipment 4. Drawing 2 shows the condition of having unified the shaft 2 and the stopper plate 3. Drawing 4 is the detail sectional view. After forming slot 2a in the periphery of a shaft 2 and inserting in the stopper plate 3, by crushing a part of the end face, depression 3a is formed, and it deforms plastically and flows to slot 2a which is the refuge of an ingredient. In case it crushes, a fixture receives the top face of the stopper plate 3, and a peripheral face with a sufficient precision, and it is made to happen certainly near plastic flow fang furrow 2a.

[0014] For example, when the construction material of stainless steel bearing steel SUS420J2, the heat treatment degree of hardness HRC54, the shaft diameter of 3mm, the tooth depth of 0.07mm, and the stopper plate 3 was [the clearance between 0.8mm in SUS304, a degree of hardness HRC20 and thickness and fitting] 0.01mm for the construction material of a shaft 2, when about 0.1mm and depression width of face made it about 0.2mm, the depression

depth is the crushing load of 200kgf extent, and has been firmly unified by plastic flow.

[0015] In order to set up the thrust direction clearance delta between the stopper plate 3 and one edge of the bearing metal 12 which counters with high degree of accuracy, the right-angle precision of the shaft orientations of a shaft 2 and the top face of the stopper plate 3 is important, but if the receptacle part of a crushing fixture is manufactured with a sufficient precision, it will learn from this and will unite with it. The thrust direction clearance delta is a value around 10 micrometers here. Although the outer-diameter precision of a shaft 2 needs tolerance width of face of 1 micrometer, and about 0.1 micrometers of roundness errors, the process which really [cut] uses the stopper plate 3 and a shaft 2 as an object is next to impossible on mass production level. If a shaft 2 and the stopper plate 3 are independently manufactured like this invention, it is easy to raise each process tolerance.

[0016] Next, the fit-in approach of a thrust pad 10 is explained. In drawing 5 in the condition of having reversed drawing 2 , what unified the shaft 2 and the stopper plate 3 first (condition of drawing 3) is inserted until it contacts to the end face of bearing metal 12. Subsequently, only 2 double part of the predetermined thrust direction clearance delta raises a shaft 2 for the soffit section (drawing 5) of a shaft 2 after a carrier beam with a fixture. This actuation

measures the stroke of shaft orientations with a displacement measurement vessel, and lifting a fixture with oil pressure etc. can constitute it easily.

[0017] Subsequently, in order to press a thrust pad 10 fit in the bearing housing 11, a thrust pad 10 is carried from the upper part, and a fixture is applied and stuffed into the top face. If it will push in further by delta from this event in the pivot bearing section 18 if it pushes in, and it is made to stop, remaining delta will be automatically set up as a thrust direction clearance. Although early setting out was set to 2delta here, you may set it as any value.

[0018] With the position of drawing 2 which reversed the condition of drawing 5 , after pouring in a magnetic fluid from the upper part to the top face of bearing metal 12, the seal member 9 is pressed fit in the bearing housing 11. The seal members 9 are ingredients, such as brass and stainless steel, are made into a larger (about dozens of micrometers) bore a little than the outer diameter of a shaft 2, and are considered as non-contact opposite. Since the seal magnet 8 is installed in the center section, the force which can always be drawn near to a center section is acting, and, outside, a magnetic fluid does not leak. Here, in order to make a magnetic fluid certainly full in ** 13, a magnet is put on the thrust pad 10 bottom, and the magnetic-attraction force is given from the exterior. Thereby, the poured-in magnetic fluid is drawn in ** 13. Under the present circumstances, in order are [internal air] outside recess-easy and to make it into

it, the slot on the shaft orientations is established in the periphery of bearing metal 12. A slot is similarly established in the periphery of the seal magnet 8, or the clearance is made to be made between the bores of the bearing housing 11.

[0019] Therefore, the bearing assembly condition of drawing 2 can be dealt with as components of a piece, and it becomes possible to perform easily clearance management of the thrust direction of a shaft and bearing, and a radial direction, the dimensional control of each part, etc.

[0020]

[Effect of the Invention] Since it was made to be combined with the slot which prepared the plate for the thrust direction regulation in the shaft by plastic flow according to this invention, the omission reinforcement of the thrust direction is high and becomes the thing excellent in shock resistance. Moreover, since the receptacle member to which the end-face section supports the shaft of a spherical-surface configuration constituted so that it might be pressed fit in bearing housing possible [the thrust direction adjustment], while it can set up the clearance between a plate and a bearing edge with a sufficient precision, it is small in the frictional resistance of shaft orientations, therefore can lessen the consumed electric current of a motor.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view of the spindle motor which applied the bearing equipment of this invention.

[Drawing 2] Detail drawing of the bearing equipment of drawing 1 .

[Drawing 3] Drawing which unified the shaft and stopper plate of drawing 2 .

[Drawing 4] The sectional view which expanded a part of drawing 3 .

[Drawing 5] Drawing showing the condition of having reversed drawing 2 .

[Description of Notations]

1 [-- A stopper plate, 4 / -- Bearing equipment, 5 / -- The Rota magnet, 10 / -- A thrust pad, 11 / -- Bearing housing, 12 / -- Bearing metal, 15 / -- A stator core, 18 / -- The pivot bearing section, delta / -- The thrust direction clearance.] -- A hub, 2 -- A shaft, 2a -- A slot, 3